## REMARKS/ARGUMENTS

Claims 51-90 were previously pending in the application. Claims 51-90 are canceled; and new claims 91-142 are added herein. Assuming the entry of this amendment, claims 91-142 are now pending in the application. The Applicant hereby requests further examination and reconsideration of the application in view of the foregoing amendments and these remarks.

Support for new claims 91-142 is found, for example, as follows:

| Claims | Support |
|---|---|
| 91, 113, 135 | Fig. 1 |
| 92, 114 | Fig. 1 |
| 93, 115 | Fig. 1 |
| 94, 116 | Fig. 1 |
| 95, 117 | Fig. 1 |
| 96, 118 | Fig. 1 |
| 97, 119 | Fig. 2 |
| 98, 120 | Fig. 2 |
| 99, 121, 136, 137, 138 | Fig. 3 |
| 100, 122 | Fig. 1 |
| 101, 123 | Fig. 1 |
| 102, 124 | Fig. 1 |
| 103, 125 | Figs. 7-9 |
| 104, 126 | Fig. 7 |
| 105, 127 | Fig. 8 |
| 106, 128 | Fig. 9 |
| 107, 129 | Fig. 1 |
| 108, 130 | Fig. 6 |
| 109, 131 | Fig. 11 |
| 110, 132 | Fig. 11 |
| 111, 133 | Fig. 11 |
| 112, 134 | Fig. 1 |
| 139, 140 | Figs. 1 and 5 |
| 141, 142 | Fig. 1 |

In paragraph 2 of the office action, the Examiner rejected claims 51-53, 55-70, and 72-86 under 35 U.S.C. 102(b) as being anticipated by Briffa. In paragraph 4, the Examiner rejected claims 54 and 71 under 35 U.S.C. 103(a) as being unpatentable over Briffa in view of Kimura. In paragraph 5, the Examiner rejected claims 87-90 under 35 U.S.C. 102(b) as being anticipated by Cavers. For the following reasons, the Applicant submits that all of the now-pending claims are allowable over the cited references.

Claims 91, 113, and 135

New claim 91 is directed to an apparatus for generating a predistorted signal from an input signal to reduce distortion in an output signal generated by signal handling equipment based on the predistorted signal. The apparatus comprises an extractor, a generator, and a modulator. The extractor is adapted to generate an extracted signal from the input signal. The generator is adapted to generate a distortion signal based on the extracted signal, wherein the distortion signal comprises a second-order distortion component based on a second-order signal generated from the extracted signal and a fourth-order

distortion component based on a fourth-order signal generated from the extracted signal. The modulator is adapted to modulate the input signal based on the distortion signal to generate the predistorted signal. None of the cited references teaches such a combination of features.

For example, Briffa teaches, in Equations (2a) and (2b), a predistortion circuit (37) that generates a predistortion signal having three components: a second-order component based on a second-order signal generated from a signal extracted from the input signal, a first-order component based on a first-order signal generated from the extracted signal, and a zeroth-order component based on a zeroth-order signal. Significantly, Briffa does not teach or even suggest a predistortion circuit that generates a fourth-order predistortion component based on a fourth-order signal generated from a signal extracted from the input signal.

If anything, Briffa teaches away from a predistortion circuit that generates a fourth-order predistortion component based on a fourth-order signal generated from a signal extracted from the input signal. In particular, in column 8, lines 16-22, Briffa teaches that the "additional term" in Equation (5) "compensates for many IMD products well beyond the third order IMD products." As such, Briffa essentially teaches away from predistortion circuits that generate fourth-order predistortion components, since the IMD products corresponding to those components would already be compensated for by Briffa's "additional term."

Furthermore, Cavers teaches, e.g., in Fig. 5, a predistorter that generates a predistortion signal based on a second-order signal generated from a signal extracted from the input signal. Significantly, as with Briffa, Cavers does not teach or even suggest a predistortion circuit that generates a fourth-order predistortion component.

For all these reasons, the Applicant submits that claim 91 is allowable over the cited references. For similar reasons, the Applicant submits that claims 113 and 135 are allowable over the cited references. Since claims 92-112, 114-134, and 139-142 depend variously from claims 91 and 113, it is further submitted that those claims are also allowable over the cited references.

Claims 92 and 114

According to claim 92, the distortion signal further comprises a sixth-order distortion component based on a sixth-order signal generated from the extracted signal. As described previously, the cited references do not teach any distortion components of order greater than two, let alone a sixth-order distortion component. The Applicant submits that this provides additional reasons for the allowability of claims 92 and 114 over the cited references.

Claims 93 and 115

According to claim 93, the distortion signal does not comprise any odd-order distortion components based on any odd-order signal generated from the extracted signal. Briffa teaches a predistortion signal having a first-order distortion component based on a first-order signal generated from a signal extracted from the input signal. The Applicant submits that this provides additional reasons for the allowability of claims 93 and 115 over Briffa.

Claims 94 and 116

According to claim 94, the generator is a digital generator adapted to digitally generate the distortion signal. In rejecting claim 51, the Examiner stated on page 2 that Briffa teaches "a generator for

generating digitally a distortion signal," citing predistortion circuit 37 of Fig. 4. The Applicant submits that the Examiner mischaracterized the teachings in Briffa in rejecting claim 51.

In particular, Briffa teaches an analog generator that generates a distortion signal using analog processing components. See, e.g., column 5, lines 56-59. If anything, Briffa teaches away from digitally generating a distortion signal. See, e.g., column 4, lines 11-12 ("Thus, systems using DSP are typically not suitable for wideband applications.").

The Applicant submits that this provides additional reasons for the allowability of claims 94 and 116 over Briffa.

Claims 97 and 119

According to claim 97, the modulator is adapted to (i) divide the input signal into an in-phase component and a quadrature component; (ii) multiply one of the in-phase and quadrature components by the distortion signal to generate a first product; (iii) multiply the other component by only a first DC distortion component to generate a second product; and (iv) combine the first and second products to generate the predistorted signal.

In Briffa, an in-phase component of the input signal is multiplied by an in-phase distortion signal having zeroth-, first-, and second-order terms, and a quadrature component of the input signal is multiplied by a quadrature distortion signal having zeroth-, first-, and second-order terms. This is different from claim 97, where one of the in-phase and quadrature components of the input signal is multiplied by the distortion signal (which may include both in-phase and quadrature distortion components) and the other input signal component is multiplied by only a DC distortion component.

None of the other cited references teaches or even suggests the features of claim 97.

The Applicant submits that this provides additional reasons for the allowability of claims 97 and 119 over the cited references.

Claims 99 and 121

According to claim 99, automatic gain control (AGC) circuitry is adapted to condition the extracted signal so that an envelope of the conditioned signal maintains a substantially constant amplitude.

In the embodiment of the present invention shown in Fig. 3, for example, the AGC circuitry includes variable gain element 310 and amplifier 312, where variable gain element 310 is controlled based on a control signal generated by detecting and integrating the squared extracted input signal and comparing the integrated result to a reference signal Ref in order to keep the amplitude of the conditioned signal envelope substantially constant.

In rejecting claims 63 and 80, the Examiner stated that "Briffa teaches a signal conditioner for conditioning the signal input to the generator so that the signal input maintains a substantially constant amplitude," citing variable gain amplifier (VGA) 51 of predistortion circuit 37 of Fig. 4 and column 7, lines 42-64. The Applicant respectfully submits that the Examiner mischaracterized these teachings in Briffa.

In column 7, lines 59-62, Briffa teaches that "VGA 51 scales the clipped signal and enables the entire PreD **37** circuit to be switched off or progressively disabled in response to a control voltage applied at terminal **C4**." The Applicant submits that none of this teaches or even suggests conditioning the input signal so that the conditioned signal envelope maintains a substantially constant amplitude.

None of the other cited references teaches or even suggests the features of claim 99.

The Applicant submits that this provides additional reasons for the allowability of claims 99 and 121 over the cited references.

Claims 101 and 123

According to claim 100, a controller is adapted to control operations of the generator. According to claim 101, which depends from claim 100, the apparatus further comprises one or more mixers, where each mixer is adapted to multiply a portion of the extracted signal by a portion of the output signal to generate an input signal to the controller.

The Applicant submits that none of the cited references teaches such a combination of features. For example, Briffa teaches a coupler 46 in Fig. 3 that combines a portion of a signal extracted from the input signal with a portion of the output signal by subtraction, but not by multiplication, to generate (via coupler 45) an input signal to a controller.

The Applicant submits that this provides additional reasons for the allowability of claims 101 and 123 over the cited references.

Claims 102 and 124

According to claim 102, a first mixer is adapted to multiply an in-phase portion of the extracted signal by a first portion of the output signal to generate an in-phase input signal to the controller, and a second mixer is adapted to multiply a quadrature portion of the extracted signal by a second portion of the output signal to generate a quadrature input signal to the controller. Since none of the cited references teaches such a combination of features, the Applicant submits that this provides additional reasons for the allowability of claims 102 and 124 over the cited references.

Claims 103 and 125

According to claim 100, a controller is adapted to control operations of the generator. According to claim 103, which depends from claim 100, the controller comprises two or more control paths, each control path adapted to generate a different-order control signal used by the generator to generate a different distortion component in the distortion signal. Since none of the cited references teaches such a combination of features, the Applicant submits that this provides additional reasons for the allowability of claims 103 and 125 over the cited references.

Claims 104 and 126

According to claim 104, each control path comprises (i) a mixer adapted to multiply a portion of the output signal by a different-order signal generated from the extracted signal to generate a product and (ii) an integrator adapted to integrate the product to generate a corresponding control signal. Since none of the cited references teaches such a combination of features, the Applicant submits that this provides additional reasons for the allowability of claims 104 and 126 over the cited references.

Claims 105 and 127

According to claim 105, the controller comprises a transformer adapted to generate different-frequency components of the output signal, and each control path comprises (i) a detector adapted to detect a power level of a different-frequency output component and (ii) an integrator adapted to integrate the detected power level to generate a corresponding control signal. Since none of the cited references teaches such a combination of features, the Applicant submits that this provides additional reasons for the allowability of claims 105 and 127 over the cited references.

Claims 106 and 128

According to claim 106, each control path comprises (i) a band-pass filter adapted to isolate a different-frequency component of the output signal, (ii) a detector adapted to detect a power level of the different-frequency output component, and (iii) an integrator adapted to integrate the detected power level to generate a corresponding control signal. Since none of the cited references teaches such a combination of features, the Applicant submits that this provides additional reasons for the allowability of claims 106 and 128 over the cited references.

Claims 109 and 131

According to claim 109, the modulator comprises a phase shifter, an amplitude modulator, and a coupler. The amplitude modulator is adapted to modulate the amplitude of the input signal based on the distortion signal, and the coupler is adapted to combine the outputs from the phase shifter and the amplitude modulator to generate the predistorted signal. Since none of the cited references teaches such a combination of features, the Applicant submits that this provides additional reasons for the allowability of claims 109 and 131 over the cited references.

Claims 110 and 132

According to claim 110, the phase shifter is adapted to shift the phase of a first portion of the input signal, and the amplitude modulator is adapted to modulate the amplitude of a second portion of the input signal, different from the first portion. Since none of the cited references teaches such a combination of features, the Applicant submits that this provides additional reasons for the allowability of claims 110 and 132 over the cited references.

Claims 111 and 133

According to claim 111, a second phase shifter is adapted to shift phase of one of a portion of the extracted signal and a portion of the output signal, wherein the portions are combined to generate a signal used to control operations of the generator. Since none of the cited references teaches such a combination of features, the Applicant submits that this provides additional reasons for the allowability of claims 111 and 133 over the cited references.

Claims 136, 137, and 138

Independent claim 136 is directed to apparatus for generating a predistorted signal from an input signal to reduce distortion in an output signal generated by signal handling equipment based on the predistorted signal. The apparatus comprises (i) an extractor adapted to generate an extracted signal from the input signal, (ii) automatic gain control (AGC) circuitry adapted to condition the extracted signal so that the conditioned signal envelope maintains a substantially constant amplitude, (iii) a generator

adapted to generate a distortion signal based on the conditioned signal, and (iv) a modulator adapted to modulate the input signal based on the distortion signal to generate the predistorted signal. For the same reasons given previously with regard to claims 99 and 121, the Applicant submits that independent claims 136, 137, and 138 are allowable over the cited references.

In view of the foregoing, the Applicant submits that the rejections of claims under Sections 102(b) and 103(a) have been overcome.

In view of the above amendments and remarks, the Applicant believes that the now-pending claims are in condition for allowance. Therefore, the Applicant believes that the entire application is now in condition for allowance, and early and favorable action is respectfully solicited.

Respectfully submitted,

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